



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL MARINE FISHERIES SERVICE  
Northwest and Alaska Fisheries Center

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**CRUISE REPORT**

Fisheries Agency of Japan Charter Vessel  
Tomi Maru No. 88  
Cruise No. 88-01

Japan-U.S. cooperative longline survey for sablefish  
and Pacific cod in the Aleutian region,  
eastern Bering Sea, and Gulf of Alaska, 1988.

Prepared by David M. Clausen

**INTRODUCTION**

Since 1978, the Fisheries Agency of Japan, in cooperation with the Northwest and Alaska Fisheries Center (NWAFC) of the U.S. National Marine Fisheries Service, has conducted an annual longline survey in the northeastern Pacific Ocean along Alaska's continental slope. The 1988 survey was conducted between May and September, using the Tomi Maru No. 88, a commercial Japanese longline vessel chartered by the Fisheries Agency of Japan. As in previous years, the survey was directed primarily at sablefish (Anoplopoma fimbria) and Pacific cod (Gadus macrocephalus) between depths of 100 m and 1,000 m. Areas surveyed included the western Aleutians, eastern Aleutians, Bering I, Bering II, Bering II, Bering IV, and the following International North Pacific Fisheries Commission (INPFC) statistical areas in the Gulf of Alaska: Shumagin, Chirikof, Kodiak, Yakutat, and Southeastern (Fig. 1). These surveys now provide 10 consecutive years (1979-88) of data for the Gulf of Alaska and Aleutian region, and 7 years (1982-88) of data for the eastern Bering Sea.

**ITINERARY**

|               |  |
|---------------|--|
| 17 May        | Departed Kushiro, Japan.   |
| 18-22 May     | In transit to western Aleutian Islands.                            |
| 23 May-24 Jun | Fished 32 stations in the Aleutian Islands and eastern Bering Sea. |



|               |   |
|---------------|---|
| 25-26 Jun     | In port, Dutch Harbor, to exchange scientific personnel and restock vessel. |
| 27 Jun-26 Jul | Fished 30 stations in the eastern Bering Sea.                               |
| 27-28 Jul     | In port, Dutch Harbor, to exchange scientific personnel and restock vessel. |
| 29 Jul-20 Aug | Fished 23 stations in the western Gulf of Alaska.                           |
| 21-24 Aug     | In port, Kodiak, to exchange scientific personnel and restock vessel.       |
| 25 Aug-17 Sep | Fished 23 stations in the eastern Gulf of Alaska.                           |
| 18-20 Sep     | In transit to Seattle, Washington.  |
| 21 Sep        | Arrived Seattle, Washington; end cruise.                                    |

#### OBJECTIVES

1. Monitor annual changes in the relative abundance and size composition of sablefish and Pacific cod along the continental slope of Alaska.
2. Monitor annual changes in stock condition of other major fish species caught in the survey, including Pacific halibut (Hippoglossus stenolepis), arrowtooth flounder (Atheresthes stomias), Greenland turbot (Reinhardtius hippoglossoides), rockfish (Sebastes spp.), thornyheads (Sebastolobus spp.), and grenadiers (Macrouridae).
3. Tag sablefish throughout the cruise to determine migration patterns.
4. Collect sablefish otoliths to study age composition of the stocks.

#### METHODS

The methods used in 1988 were similar to those used in previous years. The Tomi Maru No. 88 was 51.73 m (170 ft) long and carried a crew of 25. One station was occupied each day. At each station, one longline 16 km (8.6 nmi) long was set and retrieved. The longline consisted of 160 hachis (Japanese term for "skates" or lengths of longline), each 100 m (328 ft) long, tied together. A halibut anchor was placed at each end of the longline; a 3-kg (7 lb) rock anchored each hachi. Surface buoys were attached at the beginning and end of the longline and one-third and two-thirds of the way along the line. Each hachi had

45 "J" style hooks spaced at 2 m intervals along the line. The hooks were baited with squid and were attached to the line by 1.2 m (47 in) gangions. Thus, 7,200 hooks were fished each day at a station. As in previous years, a total of 108 stations was planned for the survey.

The Tomi Maru No. 88 generally attempted to fish depths between 100 m and 1,000 m (55-548 fm) at each station. These depths correspond to the bathymetric distribution of most commercial-size sablefish in Alaskan waters. Because of bottom irregularities and the varied angle of the continental slope, it was often impossible to fish the complete depth range at all stations. The longline was usually set starting in shallow water, and then laid seaward across the isobaths of the continental slope into deeper water. At some stations, where Pacific cod was the primary species of interest and the angle of the continental slope was gradual, the entire longline was set at depths less than 400 m. Most of these shallow stations were in the eastern Bering Sea.

At each station, the soak time (time between set and retrieval) of an individual hachi depended upon the hachi's location in the longline. Setting the gear began in the early morning (0500-0600 hours) and finished within 1 h. The vessel then returned to the starting position, waited until the first hachi had been in the water for 3 h, and began hauling the gear. Retrieval of the entire longline usually lasted 6-7 h. Thus, soak time varied from 3 h at the beginning of the longline to 8 or 9 h at the end.

The catch was tallied by species and hachi as the longline was brought aboard. Also, the depth at which the fish were caught was estimated by measuring the depth of water under the vessel every fifth hachi.

The catch was then separated into individual species for further sampling. Pacific halibut were landed without a gaff, measured for length, and immediately released. Other species were retained and weighed. Commonly caught fish were individually measured to determine length frequencies. These included sablefish, Pacific cod, arrowtooth flounder, Greenland turbot, rougheye rockfish (Sebastes aleutianus), shortraker rockfish (S. borealis), shortspine thornyhead (Sebastolobus alascanus), giant grenadier (Albatrossia pectoralis), and Pacific grenadier (Coryphaenoides acrolepis). Sablefish and Pacific cod were separated by sex and depth stratum before they were measured.

At most stations, a subsample of sablefish were held in live tanks, and then tagged and released. Only robust, uninjured fish, usually <65 cm in fork length, were tagged. The tags used

were plastic Floy<sup>1</sup> anchor tags, as in previous years. The NWAFC Resource Assessment and Conservation Engineering Division (RACE) supplied the tags in the Aleutian region, eastern Bering Sea, and western half of the Gulf of Alaska (labeled "U.S. National Marine Fisheries Reward, Seattle, Washington U.S.A."). The NWAFC Auke Bay Laboratory (ABL) supplied the tags in the eastern half of the Gulf of Alaska (labeled "U.S. National Marine Fisheries Reward, Auke Bay, Alaska USA").

Sablefish otoliths were collected throughout the cruise for both Japan and the U.S. For Japan, otoliths (one per fish) were taken from 10 sablefish per centimeter length per sex in each area. For the U.S., otoliths (usually two per fish) were taken from five fish per centimeter length per sex in each of five areas: Aleutian Islands (combining western and eastern Aleutians); eastern Bering Sea (combining Bering areas I, II, III, and IV); and the Shumagin, Kodiak, and Southeastern INPFC areas in the Gulf of Alaska.

After completion of sampling, grenadiers were discarded because they were not marketable, and the rest of the catch was processed and frozen for later sale in Japan as food. Sale of the fish helped to defray the Japanese government's vessel charter costs.

Scientists from the U.S. and Japan will analyze the data collected on this survey by calculating the catch per hachi (by depth stratum and area) for each of the major species caught. Catch per hachi, a measure of species abundance, is calculated by dividing the number of fish caught by the number of hachis fished. This calculation is done for each area and by 100 m increments from 100 m to 1,000 m.

## RESULTS

The Tomi Maru No. 88 sampled all 108 stations during the 1988 cruise (Fig. 1). The stations generally were located at positions similar to those in previous years of the survey. The exact positions and depth ranges fished are listed in Table 1. During the entire cruise, 17,039 hachis or 1,704 km (922 nmi) of longline gear were set. A total of 318,980 fish was caught on the 766,755 hooks set; thus, 41.6% of the hooks caught and retained fish.

Sablefish and Pacific cod made up most of the catch (Table 2). Sablefish comprised 40.0% (127,660 fish) of the catch in numbers, and Pacific cod, 26.2% (83,553 fish). Sablefish were

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<sup>1</sup>Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

most abundant in the Gulf of Alaska, and Pacific cod were most abundant in the eastern Bering Sea. Catch rates and average weights of sablefish and Pacific cod for each station are listed in Table 3. As many as 3,850 sablefish (station 100) and 3,439 Pacific cod (station 14) were caught at a single station. Highest catches of Pacific halibut were in the eastern Aleutian area and eastern Bering Sea, and rockfish were most abundant in the Aleutians and the eastern Gulf of Alaska. In all areas, most of the rockfish catch was either shortraker or roughey rockfish. Almost all the Greenland turbot were caught in the Aleutian region or the eastern Bering Sea.

Killer whales appeared to be removing hooked fish from the longline at station numbers 17, 18, 20, 22, 25, 26, 30, 31, and 33 in the eastern Bering Sea and at station 37 in the eastern Aleutians. Because of this interference, catches are believed to be underestimated at these stations.

A total of 7,080 sablefish was tagged in the 1988 survey, 5.5% of all sablefish caught (Table 2). Most of the fish were tagged in the Gulf of Alaska. Since 1978, the cooperative longline survey has tagged 142,556 sablefish.

Otoliths were collected for the U.S. from 3,317 sablefish: 633 in the Aleutian region and eastern Bering Sea, and 2,684 in the Gulf of Alaska.

Detailed analyses of the survey results for sablefish, including length compositions and estimates of relative population numbers and weights for the Gulf of Alaska, will be completed by the Auke Bay Laboratory. A similar analysis will be done for sablefish in the Aleutian region and eastern Bering Sea by the NWAFC Resource Ecology and Fisheries Management Division. Data for all major species will also be analyzed by the Fisheries Agency of Japan, Far Seas Fisheries Research Laboratory. Results from all these analyses should be available from the NWAFC by spring, 1989.

#### SCIENTIFIC PERSONNEL

17 May-21 Sept

Kazunari Yano, Japan Marine Fishery Resources Center, Tokyo, Japan.

Kazuhiko Koike, Japan Marine Fishery Resources Center, Tokyo, Japan.

17 May-25 June

James Long, NWAFC/RACE Division, Seattle.

26 June-27 July

Ronald Payne, NWAFC/RACE Division, Seattle.

28 July-21 Aug

James Stark, NWAFC/RACE Division, Seattle.

24 Aug-21 Sept

Neva Dail Bridges, NWAFC/ABL, Auke Bay, Alaska.

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Table 1. Position and depth of each station, Japan-U.S. cooperative longline survey in the Aleutian region, eastern Bering Sea, and Gulf of Alaska, 1988.

| Station number     | Position at start of longline |       |     |        | Position at end of longline |       |     |        | Depth range |          |
|--------------------|-------------------------------|-------|-----|--------|-----------------------------|-------|-----|--------|-------------|----------|
|                    |                               |       |     |        |                             |       |     |        | shallow (m) | deep (m) |
| Eastern Bering Sea |                               |       |     |        |                             |       |     |        |             |          |
| 1                  | 58                            | 46.9' | 177 | 33.3'W | 58                          | 49.9' | 177 | 46.6'W | 155         | 710      |
| 2                  | 58                            | 37.2' | 176 | 39.0'W | 58                          | 34.3' | 176 | 54.8'W | 154         | 664      |
| 3                  | 58                            | 41.5' | 175 | 59.9'W | 58                          | 36.9' | 176 | 11.4'W | 140         | 170      |
| 4                  | 58                            | 30.2' | 175 | 39.9'W | 58                          | 29.8' | 175 | 54.4'W | 195         | 816      |
| 5                  | 58                            | 38.5' | 174 | 21.3'W | 58                          | 32.5' | 174 | 31.2'W | 156         | 215      |
| 6                  | 58                            | 20.0' | 174 | 19.5'W | 58                          | 22.3' | 174 | 25.6'W | 180         | 840      |
| 7                  | 58                            | 00.2' | 173 | 51.7'W | 57                          | 53.2' | 173 | 53.2'W | 130         | 155      |
| 8                  | 57                            | 38.4' | 174 | 10.5'W | 57                          | 44.9' | 174 | 16.7'W | 155         | 820      |
| 9                  | 57                            | 07.8' | 173 | 13.6'W | 57                          | 05.2' | 173 | 25.6'W | 128         | 225      |
| 10                 | 56                            | 48.9' | 173 | 20.5'W | 56                          | 53.9' | 173 | 25.2'W | 167         | 562      |
| 11                 | 56                            | 40.3' | 172 | 10.7'W | 56                          | 37.6' | 172 | 24.3'W | 134         | 274      |
| 12                 | 56                            | 37.7' | 172 | 20.8'W | 56                          | 31.7' | 172 | 28.8'W | 182         | 720      |
| 13                 | 56                            | 29.2' | 171 | 26.2'W | 56                          | 26.0' | 171 | 38.1'W | 161         | 670      |
| 14                 | 56                            | 16.1' | 171 | 10.5'W | 56                          | 23.8' | 171 | 16.5'W | 144         | 205      |
| 15                 | 56                            | 09.7' | 170 | 40.0'W | 56                          | 07.5' | 170 | 51.9'W | 146         | 1140     |
| 16                 | 56                            | 00.4' | 169 | 52.5'W | 56                          | 08.0' | 169 | 56.8'W | 125         | 198      |
| 17                 | 56                            | 02.9' | 169 | 38.1'W | 55                          | 58.8' | 169 | 49.5'W | 174         | 980      |
| 18                 | 56                            | 20.7' | 169 | 07.5'W | 56                          | 17.5' | 169 | 21.4'W | 133         | 215      |
| 19                 | 56                            | 01.8' | 168 | 09.4'W | 56                          | 04.7' | 168 | 23.7'W | 150         | 245      |
| 20                 | 55                            | 49.4' | 168 | 48.7'W | 55                          | 53.6' | 169 | 00.9'W | 160         | 820      |
| 21                 | 55                            | 37.3' | 168 | 14.2'W | 55                          | 34.1' | 168 | 27.1'W | 140         | 210      |
| 22                 | 55                            | 23.0' | 168 | 14.5'W | 55                          | 26.1' | 168 | 03.2'W | 197         | 680      |
| 23                 | 55                            | 03.9' | 167 | 00.6'W | 54                          | 58.6' | 167 | 12.2'W | 153         | 214      |
| 24                 | 54                            | 55.7' | 167 | 09.7'W | 54                          | 48.5' | 167 | 15.8'W | 247         | 429      |
| 25                 | 54                            | 50.5' | 167 | 19.4'W | 54                          | 45.5' | 167 | 29.3'W | 430         | 613      |
| 26                 | 54                            | 29.7' | 167 | 05.4'W | 54                          | 22.4' | 167 | 11.4'W | 485         | 720      |
| 27                 | 54                            | 40.1' | 166 | 25.2'W | 54                          | 32.8' | 166 | 31.7'W | 324         | 445      |
| 28                 | 54                            | 47.4' | 166 | 14.4'W | 54                          | 40.9' | 166 | 23.1'W | 195         | 310      |
| 29                 | 54                            | 54.7' | 166 | 01.3'W | 54                          | 48.4' | 166 | 11.9'W | 143         | 178      |
| 30                 | 54                            | 26.6' | 165 | 39.3'W | 54                          | 28.3' | 165 | 52.6'W | 144         | 480      |
| 31                 | 54                            | 09.0' | 166 | 19.0'W | 54                          | 07.8' | 166 | 29.0'W | 110         | 820      |
| 32                 | 53                            | 46.8' | 167 | 20.9'W | 53                          | 41.5' | 167 | 26.8'W | 117         | 600      |
| 33                 | 53                            | 36.9' | 168 | 18.7'W | 53                          | 37.7' | 168 | 07.2'W | 122         | 812      |
| 34                 | 53                            | 21.7' | 168 | 57.7'W | 53                          | 17.5' | 168 | 49.3'W | 450         | 830      |
| Aleutian Region    |                               |       |     |        |                             |       |     |        |             |          |
| 35                 | 53                            | 06.3' | 170 | 18.3'W | 53                          | 01.6' | 170 | 06.6'W | 177         | 720      |
| 36                 | 52                            | 49.9' | 171 | 13.7'W | 52                          | 49.7' | 171 | 02.8'W | 158         | 690      |
| 37                 | 52                            | 23.9' | 173 | 30.3'W | 52                          | 16.9' | 173 | 27.3'W | 160         | 744      |
| 38                 | 52                            | 15.1' | 174 | 50.6'W | 52                          | 20.5' | 174 | 40.2'W | 175         | 830      |

Table 1 (continued).

| Station number | Position at start of longline |       |     |        | Position at end of longline |       |     |        | Depth range |          |
|----------------|-------------------------------|-------|-----|--------|-----------------------------|-------|-----|--------|-------------|----------|
|                |                               |       |     |        |                             |       |     |        | shallow (m) | deep (m) |
| 39             | 52                            | 08.8' | 175 | 37.5'W | 52                          | 10.7' | 175 | 47.7'W | 157         | 800      |
| 40             | 51                            | 58.4' | 176 | 26.8'W | 52                          | 03.4' | 176 | 19.5'W | 114         | 900      |
| 41             | 51                            | 54.1' | 177 | 33.5'W | 51                          | 54.5' | 177 | 34.4'W | 149         | 1005     |
| 42             | 51                            | 46.3' | 178 | 57.7'W | 51                          | 39.8' | 178 | 49.6'W | 188         | 730      |
| 43             | 52                            | 02.9' | 178 | 16.7'E | 52                          | 06.8' | 178 | 27.2'E | 120         | 750      |
| 44             | 52                            | 19.5' | 176 | 12.7'E | 52                          | 15.6' | 175 | 59.6'E | 120         | 580      |
| 45             | 52                            | 40.5' | 174 | 25.2'E | 52                          | 47.0' | 174 | 15.7'E | 100         | 800      |
| 46             | 53                            | 04.4' | 172 | 52.4'E | 53                          | 07.7' | 172 | 43.5'E | 100         | 850      |
| 47             | 52                            | 32.3' | 173 | 01.0'E | 52                          | 33.1' | 172 | 47.4'E | 122         | 950      |
| 48             | 52                            | 19.9' | 174 | 15.5'E | 52                          | 14.9' | 174 | 04.3'E | 128         | 750      |
| 49             | 51                            | 40.5' | 175 | 50.1'E | 51                          | 35.2' | 175 | 41.5'E | 110         | 840      |
| 50             | 51                            | 46.2' | 176 | 59.9'E | 51                          | 41.8' | 177 | 10.4'E | 144         | 840      |
| 51             | 51                            | 34.9' | 178 | 08.1'E | 51                          | 43.2' | 178 | 07.6'E | 135         | 640      |
| 52             | 51                            | 19.6' | 179 | 04.5'E | 51                          | 12.1' | 179 | 01.5'E | 98          | 900      |
| 53             | 51                            | 23.9' | 178 | 36.6'W | 51                          | 22.4' | 178 | 26.9'W | 176         | 823      |
| 54             | 51                            | 45.7' | 178 | 10.8'W | 51                          | 44.1' | 178 | 23.7'W | 98          | 800      |
| 55             | 51                            | 35.2' | 177 | 38.9'W | 51                          | 32.0' | 177 | 49.0'W | 198         | 900      |
| 56             | 51                            | 32.6' | 176 | 51.1'W | 51                          | 26.6' | 176 | 42.7'W | 170         | 850      |
| 57             | 51                            | 44.1' | 175 | 59.6'W | 51                          | 36.1' | 176 | 00.6'W | 186         | 760      |
| 58             | 51                            | 52.7' | 175 | 07.8'W | 51                          | 44.7' | 175 | 07.9'W | 168         | 552      |
| 59             | 51                            | 53.5' | 174 | 19.7'W | 51                          | 47.9' | 174 | 28.3'W | 125         | 780      |
| 60             | 51                            | 55.2' | 173 | 30.3'W | 51                          | 52.4' | 173 | 43.1'W | 130         | 800      |
| 61             | 52                            | 27.2' | 170 | 16.8'W | 52                          | 21.5' | 170 | 23.6'W | 217         | 790      |
| Gulf of Alaska |                               |       |     |        |                             |       |     |        |             |          |
| 62             | 52                            | 35.5' | 169 | 30.7'W | 52                          | 27.8' | 169 | 30.9'W | 147         | 680      |
| 63             | 52                            | 57.9' | 168 | 09.2'W | 52                          | 51.5' | 168 | 13.6'W | 120         | 830      |
| 64             | 53                            | 11.9' | 166 | 50.7'W | 53                          | 04.0' | 166 | 53.6'W | 218         | 900      |
| 65             | 53                            | 34.0' | 165 | 41.0'W | 53                          | 26.4' | 165 | 45.8'W | 135         | 765      |
| 66             | 53                            | 44.1' | 164 | 26.5'W | 53                          | 38.0' | 164 | 33.6'W | 145         | 800      |
| 67             | 53                            | 58.4' | 163 | 14.2'W | 53                          | 52.1' | 163 | 21.2'W | 115         | 735      |
| 68             | 54                            | 04.9' | 162 | 03.6'W | 54                          | 01.8' | 162 | 15.6'W | 114         | 960      |
| 69             | 54                            | 19.2' | 161 | 03.7'W | 54                          | 11.5' | 161 | 08.2'W | 149         | 870      |
| 70             | 54                            | 21.9' | 160 | 13.0'W | 54                          | 14.3' | 160 | 16.1'W | 145         | 640      |
| 71             | 54                            | 30.4' | 159 | 14.9'W | 54                          | 22.8' | 159 | 20.9'W | 145         | 840      |
| 72             | 54                            | 38.2' | 158 | 33.2'W | 54                          | 37.1' | 158 | 40.1'W | 130         | 820      |
| 73             | 54                            | 51.5' | 157 | 44.7'W | 54                          | 44.1' | 157 | 49.1'W | 150         | 720      |
| 74             | 55                            | 13.1' | 156 | 38.7'W | 55                          | 04.8' | 156 | 42.0'W | 290         | 980      |
| 75             | 55                            | 38.6' | 155 | 51.8'W | 55                          | 30.2' | 155 | 49.8'W | 140         | 235      |
| 76             | 55                            | 44.9' | 155 | 08.0'W | 55                          | 36.9' | 155 | 11.7'W | 162         | 645      |
| 77             | 55                            | 59.0' | 154 | 37.8'W | 55                          | 52.9' | 154 | 44.9'W | 390         | 880      |
| 78             | 55                            | 59.0' | 153 | 00.5'W | 55                          | 51.4' | 154 | 02.2'W | 195         | 690      |



Table 1 (continued).

| Station number | Position at start of longline |       |     |        | Position at end of longline |       |     |        | Depth range |          |
|----------------|-------------------------------|-------|-----|--------|-----------------------------|-------|-----|--------|-------------|----------|
|                |                               |       |     |        |                             |       |     |        | shallow (m) | deep (m) |
| 79             | 56                            | 17.2' | 153 | 00.0'W | 56                          | 13.2' | 153 | 10.8'W | 130         | 740      |
| 80             | 56                            | 32.9' | 152 | 02.5'W | 56                          | 25.7' | 152 | 08.7'W | 140         | 900      |
| 81             | 57                            | 07.0' | 151 | 14.9'W | 56                          | 58.8' | 151 | 18.7'W | 200         | 820      |
| 82             | 57                            | 25.2' | 150 | 33.7'W | 57                          | 16.8' | 150 | 32.4'W | 180         | 800      |
| 83             | 57                            | 38.3' | 149 | 53.1'W | 57                          | 30.2' | 149 | 53.3'W | 360         | 750      |
| 84             | 57                            | 58.8' | 149 | 08.9'W | 57                          | 50.8' | 149 | 11.0'W | 155         | 880      |
| 85             | 58                            | 17.4' | 148 | 38.3'W | 58                          | 09.2' | 148 | 38.5'W | 180         | 936      |
| 86             | 58                            | 40.5' | 148 | 17.9'W | 58                          | 34.3' | 148 | 18.8'W | 282         | 760      |
| 87             | 59                            | 08.5' | 148 | 40.1'W | 58                          | 59.9' | 148 | 39.5'W | 145         | 250      |
| 88             | 59                            | 02.2' | 147 | 54.3'W | 58                          | 53.9' | 147 | 56.2'W | 148         | 870      |
| 89             | 59                            | 16.3' | 146 | 49.9'W | 59                          | 10.6' | 146 | 57.1'W | 197         | 850      |
| 90             | 59                            | 28.4' | 145 | 27.6'W | 59                          | 27.2' | 145 | 34.3'W | 183         | 830      |
| 91             | 59                            | 31.5' | 144 | 41.5'W | 59                          | 26.4' | 144 | 53.5'W | 188         | 860      |
| 92             | 59                            | 33.9' | 143 | 38.1'W | 59                          | 27.6' | 143 | 39.7'W | 148         | 830      |
| 93             | 59                            | 35.6' | 142 | 31.5'W | 59                          | 29.6' | 142 | 37.2'W | 178         | 920      |
| 94             | 59                            | 24.0' | 142 | 09.9'W | 59                          | 26.9' | 142 | 21.6'W | 220         | 930      |
| 95             | 59                            | 02.7' | 141 | 19.9'W | 59                          | 01.6' | 141 | 35.4'W | 280         | 864      |
| 96             | 58                            | 41.0' | 140 | 38.9'W | 58                          | 42.0' | 140 | 51.6'W | 222         | 900      |
| 97             | 58                            | 28.4' | 139 | 28.2'W | 58                          | 26.3' | 139 | 38.7'W | 190         | 865      |
| 98             | 58                            | 08.6' | 138 | 43.7'W | 58                          | 09.7' | 138 | 52.9'W | 183         | 900      |
| 99             | 57                            | 52.2' | 137 | 23.7'W | 57                          | 52.7' | 137 | 35.5'W | 209         | 860      |
| 100            | 57                            | 32.3' | 136 | 31.4'W | 57                          | 36.6' | 136 | 38.3'W | 184         | 910      |
| 101            | 57                            | 11.8' | 136 | 15.2'W | 57                          | 14.2' | 136 | 24.1'W | 224         | 885      |
| 102            | 56                            | 50.4' | 136 | 00.0'W | 56                          | 56.6' | 136 | 06.6'W | 240         | 847      |
| 103            | 56                            | 23.9' | 135 | 23.9'W | 56                          | 21.0' | 135 | 38.3'W | 156         | 380      |
| 104            | 55                            | 57.9' | 135 | 24.5'W | 56                          | 01.9' | 135 | 35.1'W | 222         | 837      |
| 105            | 55                            | 32.7' | 134 | 57.9'W | 55                          | 36.5' | 135 | 08.0'W | 214         | 885      |
| 106            | 55                            | 20.3' | 134 | 43.0'W | 55                          | 24.1' | 134 | 52.7'W | 239         | 960      |
| 107            | 54                            | 53.0' | 134 | 16.9'W | 54                          | 57.9' | 134 | 23.2'W | 228         | 940      |
| 108            | 54                            | 27.9' | 133 | 55.0'W | 54                          | 31.4' | 134 | 02.7'W | 265         | 1024     |

Table 2. Numbers of fish caught and sablefish tagged, by area<sup>1</sup>, Japan-U.S. cooperative longline survey in the Aleutian region, eastern Bering Sea, and Gulf of Alaska, 1988.

| Species                    | Western<br>Aleutians | Eastern<br>Aleutians | Bering<br>I | Bering<br>II | Bering<br>III | Bering<br>IV | Shumagin | Chirikof | Kodiak | Yakutat | South-<br>eastern | Total   |
|----------------------------|----------------------|----------------------|-------------|--------------|---------------|--------------|----------|----------|--------|---------|-------------------|---------|
| Sablefish                  | 2,165                | 8,577                | 2,778       | 4,383        | 3,449         | 1,581        | 16,647   | 15,608   | 21,211 | 26,668  | 24,593            | 127,660 |
| Pacific cod                | 8,731                | 14,816               | 4,396       | 19,665       | 15,990        | 7,659        | 5,694    | 2,916    | 1,897  | 931     | 858               | 83,553  |
| Pacific halibut            | 693                  | 2,094                | 536         | 335          | 1,159         | 260          | 723      | 233      | 313    | 157     | 356               | 6,859   |
| Arrowtooth flounder        | 321                  | 918                  | 699         | 4,797        | 2,136         | 1,865        | 1,806    | 1,698    | 2,770  | 1,361   | 819               | 19,190  |
| Greenland turbot           | 262                  | 694                  | 348         | 322          | 705           | 554          | 3        | 0        | 0      | 0       | 0                 | 2,888   |
| Rockfish <sup>2</sup>      | 2,119                | 1,495                | 289         | 31           | 87            | 18           | 1,048    | 277      | 528    | 979     | 1,370             | 8,241   |
| Thornyheads                | 1,534                | 684                  | 788         | 32           | 16            | 4            | 1,548    | 1,108    | 1,907  | 1,336   | 997               | 9,954   |
| Other                      | 9,295                | 7,663                | 2,160       | 8,607        | 4,366         | 3,634        | 5,674    | 5,727    | 6,258  | 4,787   | 2,464             | 60,635  |
| All species<br>combined    | 25,120               | 36,941               | 11,994      | 38,172       | 27,908        | 15,575       | 33,143   | 27,567   | 34,884 | 36,219  | 31,457            | 318,980 |
| No. of sablefish<br>tagged | 189                  | 390                  | 125         | 147          | 148           | 65           | 589      | 1,015    | 1,496  | 1,607   | 1,309             | 7,080   |
| No. of stations            | 10                   | 17                   | 5           | 14           | 9             | 6            | 10       | 7        | 10     | 11      | 9                 | 108     |

<sup>1</sup>For location of areas, see Figure 1.

<sup>2</sup>Includes all species of rockfish (Sebastes spp.); does not include thornyheads (Sebastolobus spp.).

Table 3. Catch rates and average weights of sablefish and Pacific cod at each station, Japan-U.S. cooperative longline survey in the Aleutian region, eastern Bering Sea, and Gulf of Alaska, 1988.

| Station<br>no. | <u>Sablefish</u>         |                              | <u>Pacific cod</u>       |                              |
|----------------|--------------------------|------------------------------|--------------------------|------------------------------|
|                | No. caught/<br>100 hooks | average round<br>weight (lb) | No. caught/<br>100 hooks | average round<br>weight (lb) |
| Bering IV      |                          |                              |                          |                              |
| 1              | 4.94                     | 6.6                          | 28.65                    | 7.9                          |
| 2              | 1.90                     | 6.4                          | 21.35                    | 8.4                          |
| 3              | 0.00                     | -                            | 19.18                    | 7.7                          |
| 4              | 6.10                     | 7.1                          | 11.15                    | 8.2                          |
| 5              | 0.00                     | -                            | 21.22                    | 6.2                          |
| 6              | 9.01                     | 7.7                          | 4.82                     | 9.9                          |
| Bering III     |                          |                              |                          |                              |
| 7              | 0.00                     | -                            | 23.19                    | 11.5                         |
| 8              | 4.74                     | 7.7                          | 18.33                    | 8.4                          |
| 9              | 0.00                     | -                            | 40.25                    | 8.8                          |
| 10             | 10.89                    | 7.7                          | 18.56                    | 8.4                          |
| 11             | 0.04                     | 4.9                          | 34.39                    | 8.2                          |
| 12             | 8.90                     | 6.4                          | 6.46                     | 7.3                          |
| 13             | 14.82                    | 6.6                          | 14.61                    | 7.3                          |
| 14             | 0.31                     | 7.3                          | 47.76                    | 9.0                          |
| 15             | 8.21                     | 6.2                          | 18.53                    | 7.3                          |
| Bering II      |                          |                              |                          |                              |
| 16             | 0.00                     | -                            | 46.29                    | 6.6                          |
| 17             | 1.68                     | 6.6                          | 23.00                    | 10.1                         |
| 18             | 5.64                     | 4.6                          | 19.79                    | 7.9                          |
| 19             | 0.13                     | 5.7                          | 37.35                    | 7.1                          |
| 20             | 1.33                     | 6.0                          | 19.79                    | 9.9                          |
| 21             | 0.00                     | -                            | 35.08                    | 9.3                          |
| 22             | 1.93                     | 5.7                          | 9.01                     | 6.8                          |
| 23             | 0.96                     | 4.4                          | 23.61                    | 9.0                          |
| 24             | 13.50                    | 5.1                          | 16.49                    | 7.5                          |
| 25             | 0.71                     | 4.0                          | 0.01                     | 8.4                          |
| 26             | 6.53                     | 4.6                          | 0.00                     | -                            |
| 27             | 17.82                    | 5.3                          | 6.74                     | 6.2                          |
| 28             | 8.74                     | 4.9                          | 16.83                    | 7.9                          |
| 29             | 1.92                     | 5.3                          | 19.13                    | 9.5                          |
| Bering I       |                          |                              |                          |                              |
| 30             | 0.47                     | 4.6                          | 4.40                     | 7.7                          |
| 31             | 3.78                     | 6.8                          | 14.33                    | 7.3                          |
| 32             | 7.85                     | 7.1                          | 27.75                    | 7.3                          |
| 33             | 4.01                     | 6.4                          | 14.57                    | 5.7                          |
| 34             | 22.47                    | 6.8                          | 0.00                     | -                            |

Table 3 (continued).

| Station<br>no.    | <u>Sablefish</u>         |                              | <u>Pacific cod</u>       |                              |
|-------------------|--------------------------|------------------------------|--------------------------|------------------------------|
|                   | No. caught/<br>100 hooks | average round<br>weight (lb) | No. caught/<br>100 hooks | average round<br>weight (lb) |
| Eastern Aleutians |                          |                              |                          |                              |
| 35                | 5.00                     | 7.7                          | 11.49                    | 5.1                          |
| 36                | 0.18                     | 7.3                          | 8.32                     | 7.3                          |
| 37                | 6.79                     | 4.4                          | 12.14                    | 7.7                          |
| 38                | 10.42                    | 7.5                          | 27.24                    | 9.7                          |
| 39                | 16.26                    | 7.3                          | 7.36                     | 5.1                          |
| 40                | 12.71                    | 7.5                          | 5.89                     | 6.4                          |
| 41                | 5.07                     | 7.1                          | 4.35                     | 6.0                          |
| 42                | 5.83                     | 6.2                          | 14.33                    | 4.9                          |
| Western Aleutians |                          |                              |                          |                              |
| 43                | 3.39                     | 5.5                          | 8.83                     | 7.9                          |
| 44                | 3.28                     | 7.5                          | 17.44                    | 10.8                         |
| 45                | 1.97                     | 8.4                          | 19.13                    | 9.7                          |
| 46                | 1.69                     | 7.7                          | 8.67                     | 13.5                         |
| 47                | 1.04                     | 8.2                          | 8.21                     | 4.4                          |
| 48                | 1.71                     | 8.8                          | 15.24                    | 6.2                          |
| 49                | 6.53                     | 9.7                          | 3.50                     | 15.9                         |
| 50                | 8.35                     | 9.3                          | 13.15                    | 9.5                          |
| 51                | 1.69                     | 6.6                          | 13.17                    | 7.1                          |
| 52                | 0.42                     | 6.8                          | 13.93                    | 6.8                          |
| Eastern Aleutians |                          |                              |                          |                              |
| 53                | 12.42                    | 6.4                          | 10.00                    | 5.3                          |
| 54                | 8.04                     | 8.2                          | 4.43                     | 6.6                          |
| 55                | 5.54                     | 6.4                          | 13.42                    | 5.3                          |
| 56                | 3.96                     | 6.2                          | 11.83                    | 9.9                          |
| 57                | 8.42                     | 5.7                          | 14.17                    | 9.9                          |
| 58                | 4.82                     | 4.9                          | 18.22                    | 6.4                          |
| 59                | 4.93                     | 6.6                          | 16.25                    | 10.1                         |
| 60                | 3.79                     | 7.1                          | 15.75                    | 9.0                          |
| 61                | 4.94                     | 7.7                          | 10.60                    | 5.3                          |
| Shumagin          |                          |                              |                          |                              |
| 62                | 7.18                     | 7.3                          | 4.15                     | 7.1                          |
| 63                | 15.40                    | 6.6                          | 12.96                    | 6.8                          |
| 64                | 24.10                    | 6.2                          | 4.56                     | 5.7                          |
| 65                | 25.25                    | 5.7                          | 8.19                     | 6.8                          |
| 66                | 33.75                    | 6.2                          | 4.38                     | 8.2                          |
| 67                | 29.78                    | 7.5                          | 11.99                    | 6.0                          |
| 68                | 22.79                    | 7.7                          | 3.82                     | 7.3                          |
| 69                | 17.68                    | 6.2                          | 7.40                     | 6.0                          |
| 70                | 25.99                    | 6.4                          | 10.82                    | 6.4                          |
| 71                | 29.29                    | 6.8                          | 10.82                    | 7.3                          |

Table 3 (continued).

| Station<br>no. | <u>Sablefish</u>         |                              | <u>Pacific cod</u>       |                              |
|----------------|--------------------------|------------------------------|--------------------------|------------------------------|
|                | No. caught/<br>100 hooks | average round<br>weight (lb) | No. caught/<br>100 hooks | average round<br>weight (lb) |
| Chirikof       |                          |                              |                          |                              |
| 72             | 28.38                    | 7.1                          | 7.26                     | 6.4                          |
| 73             | 30.58                    | 6.4                          | 10.86                    | 6.2                          |
| 74             | 38.10                    | 7.5                          | 0.17                     | 6.4                          |
| 75             | 13.97                    | 5.3                          | 16.32                    | 6.2                          |
| 76             | 37.43                    | 6.4                          | 1.24                     | 5.3                          |
| 77             | 30.28                    | 6.6                          | 0.00                     | -                            |
| 78             | 38.04                    | 6.6                          | 4.65                     | 5.3                          |
| Kodiak         |                          |                              |                          |                              |
| 79             | 44.29                    | 7.3                          | 0.65                     | 8.6                          |
| 80             | 19.15                    | 6.6                          | 8.67                     | 5.1                          |
| 81             | 27.96                    | 6.8                          | 1.81                     | 5.3                          |
| 82             | 24.81                    | 6.6                          | 2.47                     | 5.3                          |
| 83             | 24.06                    | 6.6                          | 0.00                     | -                            |
| 84             | 28.78                    | 6.4                          | 6.42                     | 5.1                          |
| 85             | 25.65                    | 7.3                          | 0.86                     | 5.1                          |
| 86             | 27.81                    | 7.1                          | 0.14                     | 4.0                          |
| 87             | 37.90                    | 7.3                          | 3.79                     | 4.4                          |
| 88             | 34.19                    | 7.1                          | 1.54                     | 4.9                          |
| Yakutat        |                          |                              |                          |                              |
| 89             | 34.42                    | 7.1                          | 1.50                     | 5.5                          |
| 90             | 28.24                    | 7.3                          | 1.68                     | 6.6                          |
| 91             | 36.60                    | 7.5                          | 0.69                     | 4.9                          |
| 92             | 33.01                    | 7.3                          | 3.92                     | 4.0                          |
| 93             | 43.00                    | 7.9                          | 2.60                     | 5.3                          |
| 94             | 36.69                    | 6.8                          | 1.03                     | 4.9                          |
| 95             | 34.00                    | 6.8                          | 0.00                     | -                            |
| 96             | 30.14                    | 7.7                          | 0.00                     | -                            |
| 97             | 27.38                    | 7.3                          | 1.38                     | 8.4                          |
| 98             | 26.69                    | 7.9                          | 0.14                     | 11.5                         |
| 99             | 40.22                    | 8.6                          | 0.00                     | -                            |

Table 3 (continued).

| Station<br>no. | <u>Sablefish</u>         |                              | <u>Pacific cod</u>       |                              |
|----------------|--------------------------|------------------------------|--------------------------|------------------------------|
|                | No. caught/<br>100 hooks | average round<br>weight (lb) | No. caught/<br>100 hooks | average round<br>weight (lb) |
| Southeastern   |                          |                              |                          |                              |
| 100            | 53.47                    | 7.9                          | 0.40                     | 8.4                          |
| 101            | 50.93                    | 7.9                          | 0.03                     | 7.1                          |
| 102            | 36.75                    | 7.9                          | 0.11                     | 6.2                          |
| 103            | 25.94                    | 6.0                          | 5.08                     | 7.9                          |
| 104            | 39.72                    | 6.6                          | 1.15                     | 4.6                          |
| 105            | 38.47                    | 7.1                          | 3.13                     | 5.7                          |
| 106            | 40.54                    | 6.8                          | 0.46                     | 4.9                          |
| 107            | 29.42                    | 7.7                          | 0.89                     | 4.4                          |
| 108            | 26.32                    | 7.3                          | 0.67                     | 5.1                          |

Note: Catch rates at stations 17, 18, 20, 22, 25, 26, 30, 31, 33, and 37 may be somewhat underestimated because of killer whale interference with the longline.

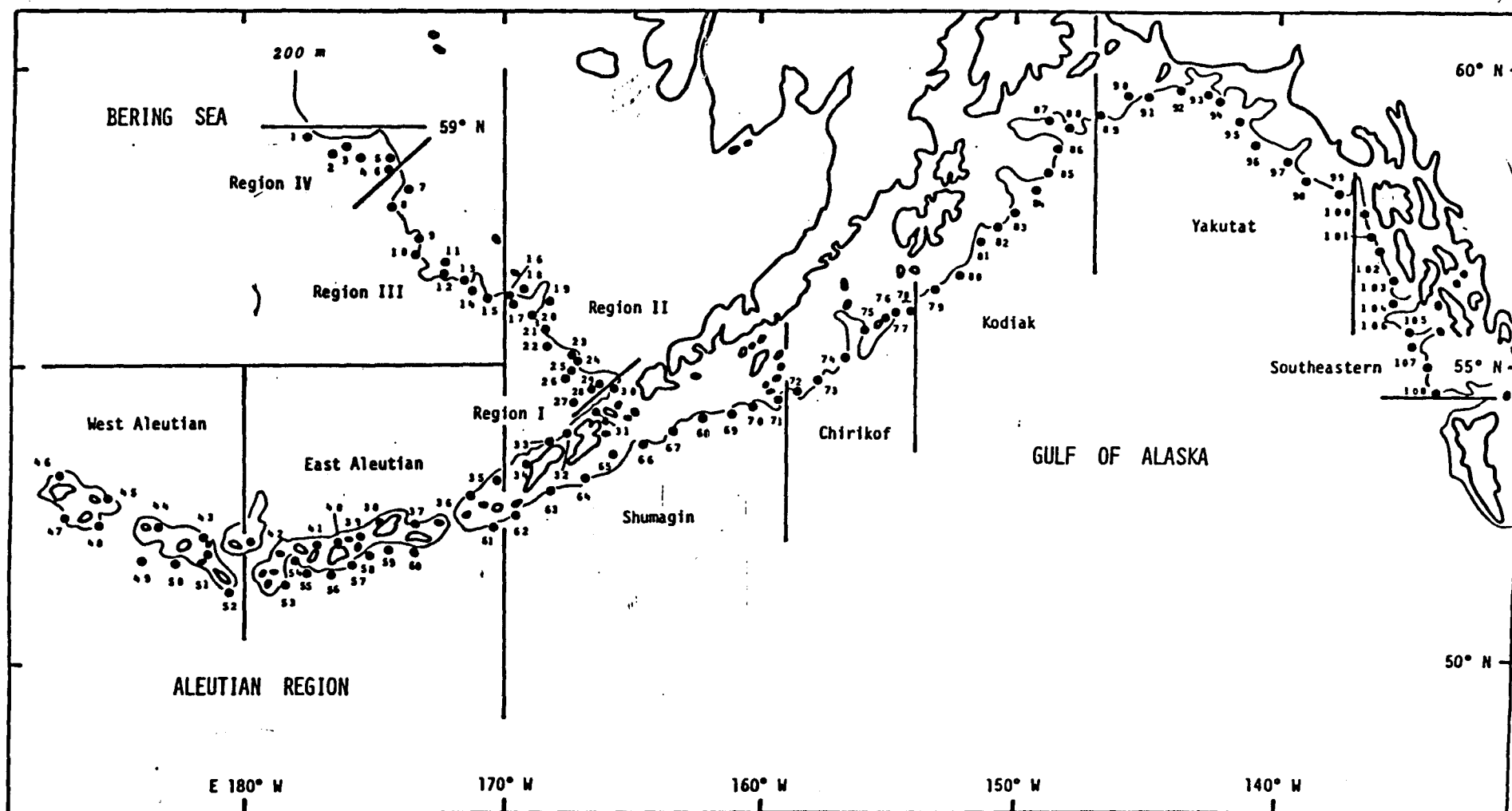


Figure 1. Location of stations, Japan-U.S. cooperative longline survey in the Aleutian region, eastern Bering Sea, and Gulf of Alaska, 1988.